State Design Matters: How Representations Shape Dynamic Reasoning in Large Language Models

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Paper under double-blind review

1 Appendix

Example 1: Agent Prompt

You are an intelligent agent with the goal of succeeding in the game by maximizing the cumulative score. Your decisions should be based on the game manual, the current observation, and your past trajectory.
 # Task:

1. Analyze the current observation and past trajectory to select the most suitable action that aligns with the game's objectives and maximizes cumulative rewards.
2. Choose one action from the provided list of actions, starting from index 1, and provide a concise reason for your choice.

 # Response Constraints:

1. Select only one action from the provided list.
2. Provide reasoning that directly links the chosen action to the game's objectives and observed patterns.
3. Respond strictly with the action and the reason in the specified format.

 # Response Format:
Action: [action number]. Reason: [explanation]
 # Input data
Game Description: {manual}
Current observation: {obs}
Past trajectory: {Full trajectory} OR {Summarized trajectory}
Question: {question}

Example 2: Summarization Prompt

Your role is to compress the recent trajectory into a concise summary that an agent can reuse next step.
Game Description: {manual}
Recent history (most recent last): {recent_history}
Previous rolling summary: {previous_summary}
Task:

- Produce a new summary $\leq$25 tokens.
- Mention agent location, key items/inventory, goals/hazards, and momentum toward objectives.
- Do not restate every step; only the most salient facts.
- If the history is empty, return "Start of game".
- Do not only repeat an action, but summarize what actions led to what outcomes.

Respond strictly in this exact format. The summary should be one sentence only, but you can use a comma.
Summary: <concise summary here>

Example 3: Visualization-of-Thought Prompt

You are an intelligent agent whose objective is to maximize cumulative score in the game. Ground every decision in the game manual, the current observation, and your remembered trajectory.
 # Visualization-of-Thought Protocol
You will:

- Draw a compact top-down ASCII map of the current situation before choosing an action.
- Update that map as you reason about candidate moves, annotating notable changes (e.g., planned path, hazards, inventory).
- Decide the single best next action from the provided list.

Guidelines for the ASCII map:

- The ASCII map must represent only what is explicitly visible in the observation.
- Keep it $\leq 6 \times 6$ unless the observation explicitly demands more detail.
- Use consistent symbols (e.g., `A` for agent, `G` for goal, `#` for wall, `.` for empty) and include a legend when helpful.
- If multiple hypothetical moves are considered, show intermediate marks such as `?` or arrow glyphs to illustrate your updates.
- If the environment is non-grid-based (e.g., Hanoi), draw the most compact symbolic state instead of a grid.

 # Required Output Sections

1. **Map (Top-Down View):** Latest ASCII grid after incorporating reasoning updates.
2. **Map Update Notes:** Bullet list (≤ 3 bullets) summarizing how the map changed during reasoning.
3. **Reasoning:** Brief chain-of-thought tying observation/manual to the chosen action.
4. **Action:** `Action: [number] ([action name]). Reason: [concise justification].`
5. **Summary:** Finish with `Summary: <≤25-token recap of agent location, inventory, hazards, and next intent>` so the rolling summary stays current.

 # Live Input
Game Description: {manual}
Current observation: {obs}
Past trajectory: {Full trajectory} OR {Summarized trajectory}
Question: {question}

Example 4: Hanoi:NaturalLanguage

Peg A has disk 2 at the bottom, disk 1 in the middle, and disk 0 on top. Peg B is empty. Peg C is empty.

Example 5: Hanoi:DictList

'A': [2, 1, 0], 'B': [], 'C': []

Example 6: Hanoi:Matrix

[[2, 1, 0], [-1, -1, -1], [-1, -1, -1]]

Example 7: Hanoi:TaggedList

- A: |bottom, [2, 1, 0], top|
- B: |bottom, [], top|
- C: |bottom, [], top|

Example 8: Messenger:NaturalLanguage

You took action Move North.
You (agent) already have the message.
You see:
- bird 9 steps away
- ship 9 steps away
- sword 5 steps away

Example 9: Messenger:NaturalLanguagePos

You are an agent with the message. You are currently in position 5, 6. You can see a mage 3 steps to the west, a dog 1 steps to the east, a ball 3 steps to the northwest.

Example 10: Messenger: Coordinates

```
COORDINATE SYSTEM:
Agent:  (5, 5)
Entities:
airplane_0:  (5, 3)
ball_0:  (7, 5)
queen_0:  (3, 5)
```

Original View:
You (agent) don't have the message.
You see:
– airplane 2 steps to your west
– ball 2 steps to your south
– queen 2 steps to your north

Example 11: Messenger:Symbolic

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.....
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.....
.....
...G.A.M..
.....
.....E....
.....
.....
Legend:
A=agent(no msg)
P=agent(with msg)
.=empty
Entities:
E=fish
M=scientist
G=robot